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AERIAL PHOTOGRAPHS AS TAX MAPS

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STATE PLANNING BOARD
DEPARTMENT OF COMMERCE
HARRISBURG, PENNSYLVANIA

AERIAL PHOTOGRAPHS AS TAX MAPS

Many counties are planning to use aerial photography for tax assessment purposes as suggested in Act 594 of the 1951 Legislative Session. The Act declares that the Board for the Assessment and Revision of Taxes in counties of the fourth, fifth, sixth, seventh and eighth class shall have the power and it shall be its duty to "Establish a permanent system of records consisting of tax maps, property record cards and property owners' index" "(1) Tax maps of the entire county drawn to scale or aerial maps, which maps shall indicate all property and lot lines, set forth dimensions or areas, indicate whether the land is improved and identify the respective parcels or lots by a system of numbers or symbols and numbers whereby the ownership of such parcels and lots can be ascertained by reference to the property record cards and the property owners' index." The Act authorizes the Board, which is composed of the county commissioners, to appoint a Chief Assessor and other staff employees and to enter into such contracts as may be necessary to establish the Permanent Record System.

The State Planning Board has prepared the following outline for the information of county commissioners, as to the present status of the air photography program, methods for utilizing aerial maps or photographs for tax maps and suggestions concerning the collection and recording of data.

Methods and suggestions contained in this outline are based upon fifteen years of aerial photograph usage, including close cooperation with the several counties of Pennsylvania which have used aerial photographs in various phases of tax assessment work.

I. Utilization of Aerial Photographs

Aerial photographs taken by mapping cameras can be used for preparing tax assessment maps. The average sized county would require several hundred separate overlapping photographs. For tax map purposes,

such photographs may be used in any of three different ways -

(1) Line maps may be constructed from aerial photographs.

(2) The separate air photographs may be fitted together and then rephotographed as a composite or mosaic.

(3) The separate photographs, enlarged to a convenient scale and with the enlarging done with particular care as to accuracy (referred to as "ratioed" enlargements), may be used as tax maps and property lines drawn directly upon them.

Each of these three methods of use is presented in more detail in the next three paragraphs of this memorandum.

II. Drafted Line Maps

The drafting of accurate base maps from aerial photographs requires the use of complex plotting instruments. Although there are several general types of instruments available, they all use stereo-pairs of aerial photographs which are projected to form three-dimensional models of the area. These projected models are viewed in the optical system of the instrument. A floating dot in the optical system can be moved around the model and, through a mechanical linkage a pencil or pen traces its movements upon a sheet of drawing paper. The property boundaries, highways and other data can be transferred from the optical model to the drawing paper at the desired scale to form a line map. Most of the plotting instruments require special aerial photographs designed for the instrument which is being used.

There are several organizations in Pennsylvania which specialize in the preparation of maps from aerial photographs. These organizations, using the plotting instruments and skilled technical personnel necessary, can draft accurate tax assessment maps. The plotting instruments used are complex and expensive. Most organizations schedule their use for many months ahead and they are commonly used from 15 to 24 hours each day. All of the various phases of the mapping are carried on by them under controlled conditions. The tax maps are delivered complete in every detail. Such services, however, are costly and many counties may feel that they cannot afford to have the job done in this manner.

Some engineers or surveyors may be interested in undertaking the construction of tax maps for counties. If the tax maps are to be based on aerial photographs they would probably contract with an aerial photographic company to perform certain phases of the mapping work. Such an arrangement could produce a satisfactory end result, but the accuracy attainable would probably be considerably less than would be secured through concentrating the responsibility in one firm which was equipped with the complex equipment referred to above. A county should obtain expert technical advice before contracting for tax maps with organizations which are not experienced in all phases of the work.

Counties entering into contracts for the preparation of tax maps should know what the completed tax maps will cost them, how accurate they will be, exactly what services the contractor will perform, the names and facilities of all subcontractors and what portions of the over-all job will remain to be done by county employees.

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In general, because of the high cost involved, the preparation of drafted line maps from aerial photographs is not recommended for tax map purposes.

III. Aerial Photograph Mosaics

The fitting together of portions of the photographs to form a single composite or mosaic is a tedious task and also requires the use of special equipment. Each individual print must be tailor-made to fit a certain predetermined spot and developed to the proper tone. The mosaic is built up in rectangular sections and each one fits tightly against adjoining sections. Mosaics for tax assessment maps decrease the number of prints required but the different shadow lengths and shadow directions on each section often makes the interpretation of detail difficult.

Although mosaics serve many useful purposes, their use for tax assessment maps is not usually recommended.

IV. Ratioed Enlargements

Ratioed enlargements at suitable scales can be used as tax assessment maps, particularly for rural and suburban areas. As is indicated in later portions of this memorandum, they may be supplemented by block and lot maps or special large-scale aerial photographs in urban portions of the county.

The use of ratioed enlargements is, in most cases, recommended as the most economical and satisfactory means of securing tax maps in accordance with the requirements of Act 594 of the 1951 Legislative Session. The remainder of this memorandum is largely devoted to the methods of securing and utilizing such ratioed enlargements for this purpose.

V. Photographs Presently Available

State-wide aerial photography first became available in 1938-1939 as the result of a cooperative State-federal program sponsored by the State Planning Board. Some of this early photography has been used by County Commissioners as the basis for tax maps with satisfactory results and at a very moderate cost. However, during the intervening years extensive changes in land-use have made this first photography obsolete in many areas. Accordingly, a second cooperative program was instituted and is now nearing completion.

These modern aerial photographs are now available at reasonable cost for all but 14 counties. These 14 counties, originally photographed in 1938-1939, will be rephotographed this year under the current cooperative State-federal program. A list of counties, the dates when they were photographed and other pertinent data are contained in Appendix A.

VI. Type of Photography

For most counties panchromatic photography was used for the present State-federal program of aerial photography. This is the same type of film as is ordinarily used for amateur and news photographs. In counties which are largely forested, and in which there is a large proportion of evergreen trees, infra-red film was used. The infra-red film separates the various shades of green so that forest types can be recognized on the prints. Highways, water, wet spots and shadows all appear very dark on photographs printed from infra-red film. For tax assessment maps they are not so good as panchromatic photographs, although they are usable.

All of the new photography is taken upon 9 x 9 inch negatives, each covering an area approximately 15,000 feet square. The scale of the negatives is approximately 1:20,000 which is 12 inches equal 20,000 feet or

one inch equals 1,667 feet.

The photographs are taken in rows running from north to south. They overlap each other 65 per cent at the top and bottom (north and south) and 30 per cent at the sides (east and west). The 65 per cent overlap provides stereo pairs (for use in stereoscopes for study of topography). Full physical coverage (non-stereo) may be obtained from alternate prints in each row.

Precise mapping cameras are used for this photography. Lenses are calibrated by the U. S. Bureau of Standards. The focal length of the lenses approximates $8\frac{1}{4}$ inches, so that the planes must fly 13,750 feet above the mean elevation of the county in order to maintain the proper scale

VII. Accuracy of Photography

Despite the fact that the cameras, planes, and equipment used are as near perfect as can be made, and the personnel using them are highly skilled, the resulting photographs are never entirely accurate in scale. In every photograph there are small errors which for most purposes can be disregarded, as well as scale differences, angular differences and displacement of images which may be of greater concern.

The scale of any object on the photograph depends upon its distance from the lens of the camera. The closer the object is to the lens, the larger its scale will be on the photograph. Thus the scale on top of a mountain will be larger than in a valley. On every photograph there will be a different scale for each elevation of the ground.

Even a slight amount of tilt in the camera at the time of exposure results in angular differences which affect the scale at various

points of the photograph.

An object such as a silo when directly underneath the camera will appear to have the top directly above the bottom but if the silo is at one side of the photograph, the top of the silo will be displaced and appears to be farther from the center of the photograph than the bottom of the silo.

However, elevation, tilt and displacement can all be determined and corrections applied so that areas and distances can be computed with a high degree of precision. Distances and areas can be measured directly upon ratioed enlargements with sufficient accuracy to provide a check upon deed descriptions. These measurements may be further refined by computing corrections for elevation and tilt.

VIII. Identification of Photographs

The photographs are taken so that the top is toward the North. Each photograph and enlargement contains an identifying symbol and number in the upper right corner. The print symbol and number is made up of three separate parts. The first three letters identify the county; the next number and letter identifies the roll of film and the last number the print on that roll, (AQS 3F-182). The print numbers in each row follow in sequence from north to south or from south to north depending upon the direction of the plane's flight. The date appears in the upper left corner.

Except when ordering complete county coverage, prints and enlargements are ordered by their identifying symbols and numbers.

IX. Photo Index Sheets

Photo index sheets which show the proper relative position occupied by each photograph are available and must be acquired to facilitate the use of the aerial photographs. In appearance, they resemble rough mosaics. For the newer photography the number required for each county varies from one

to seven.

The photo index sheets are made by photographing assemblies of the contact prints. The prints are laid out and stapled to large boards with the upper right corner of each prints, containing the print number, visible. (See Figure I).

The photo index sheets are made on 20 by 24 inch paper. For most of the counties photographed recently, they are at a scale of 1 inch equals nearly one mile (1:62500). This is the same scale as most of the United States Geological Survey Topographic Maps.

In a few instances, where an entire county is contained on a single photo index sheet, the scale is less than one inch equals one mile.

The first and last photographs in each row on the photo index sheets contain the time of day at which the photograph was made.

X. Recommended Scales for Aerial Photography

Ratioed enlargements at a scale of one inch equals 660 feet have proved satisfactory for tax assessment purposes in rural areas. At this scale each square inch represents approximately ten acres. Enlargements at this scale are usually made upon 27 x 28 inch paper, which is about as large as can be filed conveniently or used in the field. Enlargements at a scale of one inch equals 400 feet provide more room for recording data on the smaller plats, but their size, 40 inches square makes them difficult to file or use in the field. Unless a county has facilities for using and filing enlargements at a scale of one inch equals 400 feet, it is recommended that ratioed enlargements at a scale of one inch equals 660 feet be used. The use of this scale for rural areas does not prevent a county from obtaining enlargements at one inch equals 400 feet or one inch

1900

The first thing I noticed when I stepped out of the car was the cold. It was a sharp contrast to the warm blanket I had been sitting under. I looked up at the sky, which was a pale, hazy blue. The air was still, and the only sound I could hear was the distant hum of a car engine. I took a deep breath, feeling the cold air fill my lungs. It was a strange sensation, but I knew it was real. I was here, in this place, and I was going to stay.

The next thing I noticed was the silence. It was a deep, quiet silence that seemed to wrap around me. I looked around, but I didn't see anyone. The street was empty, and the only light came from the street lamps. I felt a little lost, but I knew I had to keep going. I started walking, and the cold air felt good against my skin. I was alone, but I wasn't afraid. I was just a little bit nervous.

I walked for a while, and I started to feel better. The cold air was clearing my head, and I was starting to see things more clearly. I saw a few people in the distance, but they were too far away to talk to. I was alone, but I wasn't lonely. I was just a little bit nervous. I kept walking, and I started to feel like I was in a dream. The world was so quiet, and the air was so cold. It was a strange feeling, but I knew it was real. I was here, in this place, and I was going to stay.

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PORTION OF PHOTO INDEX SHEET



FIGURE I

equals 200 feet for selected suburban areas. These can be made from existing photography.

Figure II shows a portion of a ratioed enlargement at a scale of 1 inch equals 660 feet.

For urban areas, requiring scales larger than one inch equals 200 feet, either special aerial photographs or block and lot plan maps should be used.

Aerial photographs or mosaics at a scale of one inch equals 50 feet are satisfactory for urban areas. There are several companies in Pennsylvania specializing in large scale precision photography.

Most cities and many boroughs have official block and lot maps at scales of one inch equals 100 feet or larger which may be used for tax assessment maps.

Maps such as Sanborn Maps, which are used by most fire insurance agents, are available for cities, boroughs and other urban areas. These can be used as a base for tax assessment maps.

XI. Ordering Aerial Photographs

Counties which plan to use aerial photographs as tax maps should determine what scale will best serve their needs. If a scale of 1 inch equals 660 feet is suitable for most of the county that is the scale which should be ordered. These can be supplemented later by larger scale photographs for selected areas, but a saving of about twenty per cent in the cost of enlargements can be obtained by ordering county coverage at one scale.

Photographs must be ordered from the Aerial Photographic and Engineering Service, Production and Marketing Administration, U. S. Department of Agriculture, Washington, D.C. (For price list and instruction see last two pages of Appendix A).

PORTION OF AERIAL PHOTOGRAPH USED AS A TAX MAP
TAX DISTRICT 17; MAP #AHF-2F-158



SCALE 1"=660'

Each county will need

(A) One set of ratioed enlargements at a scale of one inch equals ____ feet of alternate prints for county coverage. (See Appendix A for the number of enlargements required.)

(B) One set of Photo Index Sheets. (See Appendix A for number required).

(C) Ratioed enlargements of certain selected photographs at scales larger than ordered under "A". These can be selected and ordered at a later date.

(D) It is very desirable that a county should have an additional set of ratioed enlargements at a scale of 1 inch equals 660 feet for field use in order to protect the record set from hard wear and possible loss.

A set of contact prints of alternate photographs can be used in the field instead of enlargements but they are not nearly as useful as the enlargements.

For County coverage, ratioed enlargements at a scale of one inch equals 660 feet cost \$1.45 each and at the scale of one inch equals 400 feet \$2.70 each. Contact prints cost 45 cents each, and photo index sheets \$1.10. (See price list following Appendix A).

Photo index sheets may be enlarged upon 40 by 40 inch paper. These enlargements are desirable for counties covered by a single photo index sheet; they cost \$5.10 each.

Under normal procedure the United States Department of Agriculture requires payment at the time an order is placed for aerial photographs. In many cases it is difficult for a county to issue a check for prepayment. Special arrangements have been made by the State Planning Board to permit counties faced with this difficulty to have the United State Department of

Agriculture bill them for the photographs after the order has been filled. Such orders should contain a statement explaining that prepayment is not possible under existing county regulations.

The prices for prints of this cooperative photography approximates the actual cost of making them in large quantities by a government agency. Prints purchased from commercial organizations are necessarily much more expensive.

XII. Preparation of Photographs for Use

Enlargements of the Record set should be stamped upon the back with a rubber stamp indicating that they are official records of the Board for the assessment and Revision of Taxes, and with such other data as the Board desires. If a field set is procured it likewise should be properly identified.

The enlargements should not be trimmed. The white border surrounding the print acts as a bumper and absorbs wear and tear which otherwise would deface the prints after a few years of use.

The enlargements may be edged with plastic tape which protects them. The tape with a device for its application may be obtained from office supply stores.

The numbers of the adjoining prints may be lettered on the white margins on all four sides close to the photograph, as an aid in using them.

City, borough and township lines should be drawn upon the photo index sheets with a reasonable degree of accuracy. Township names and the township key number or symbol should be lettered upon the photo index sheets, as well as city and borough names. Village names, highway route numbers, stream names and other desired names can be cut out of a map and fastened to the photo index sheets under small pieces of transparent Scotch tape. The

photo index sheets should provide a complete visual index of the county, so that the proper enlargements or tax maps can be selected within a few seconds after the area has been located on the photo index sheet.

XIII. Filing System

A systematic filing system should be devised for tax maps which will permit ready finding of any desired map by reference to its designating number or symbol and number. In developing this filing system it is suggested that full consideration be given to the fact that the map filing system should be keyed in with the property record card filing system, and therefore each aspect of the use of the property record card should be considered in designing the filing systems for maps and property record cards, as well as for the property owners' index cards.

In general, it is probably desirable in all cases that the tax map files and the property record card files be so designed as to recognize the division of the county into townships, boroughs and cities, and perhaps in urban areas the division of the municipalities into wards, and perhaps districts within wards.

If enlargements of existing State-Federal aerial photographs are used as tax maps, it should be noted that identifying symbols and numbers have already been assigned to each photograph. This identification system may be used as the basis for the county tax map identification system.

Suitable files should be provided for the tax maps which will protect them from dirt and damage, yet will permit ready reference to them. Various types of filing equipment may be purchased or built (drawers, shelves, hanging racks, books, etc.) and the type selected will be influenced in part by the type and size of maps utilized.

Maps and Photographs should be kept flat at all times. Once rolled it is almost impossible to straighten an aerial photograph. When they are kept in drawers or on shelves, a piece of masonite or similar hardboard should be kept on top of each stack.

One convenient form of a file for enlargements and tax maps is shown on Figure III.

The case is a dust-proof cabinet framed with hardwood with hardboard panels. The top is flat and hinged at the back. Along each side of the cabinet near the top is a hauch rail from which a number of tempered hardboard hangers can be suspended by their shoulders.

The hardboard hangers should be about two inches larger than the enlargements or tax maps.

Ten or more enlargements can be fastened on each board with spring clips. These clips, such as "Ideal" binder clips number 50, should be used only on the top. A heavy elastic band can be used near the bottom.

The case should be built half an inch wider than the hangers so that they may be moved freely back and forth along the haunch rails.

One cabinet the same depth as a standard filing case, 28 inches, will accommodate up to 400 enlargements with 30 hangers. For a smaller number of enlargements the same sized case should be used but fewer hardboard hangers will be required.

XIV. Indexing System

All photographs should be indexed by means of a visual system so that prints may be selected and removed from the files quickly. The record set of photographs should be keyed to the property record cards and to the property owners index. Certain data must be placed upon the photo index

ENLARGEMENT FILE

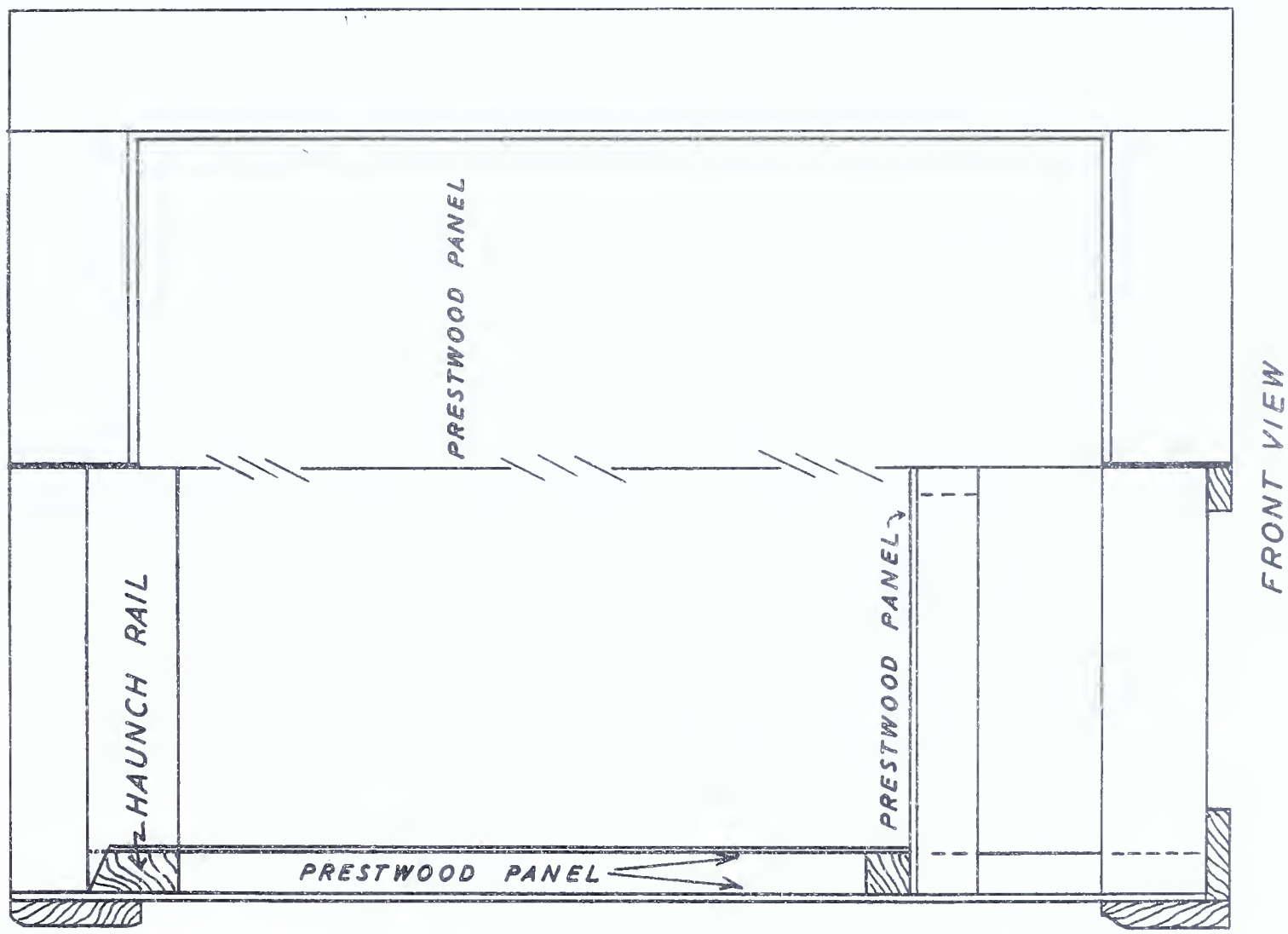
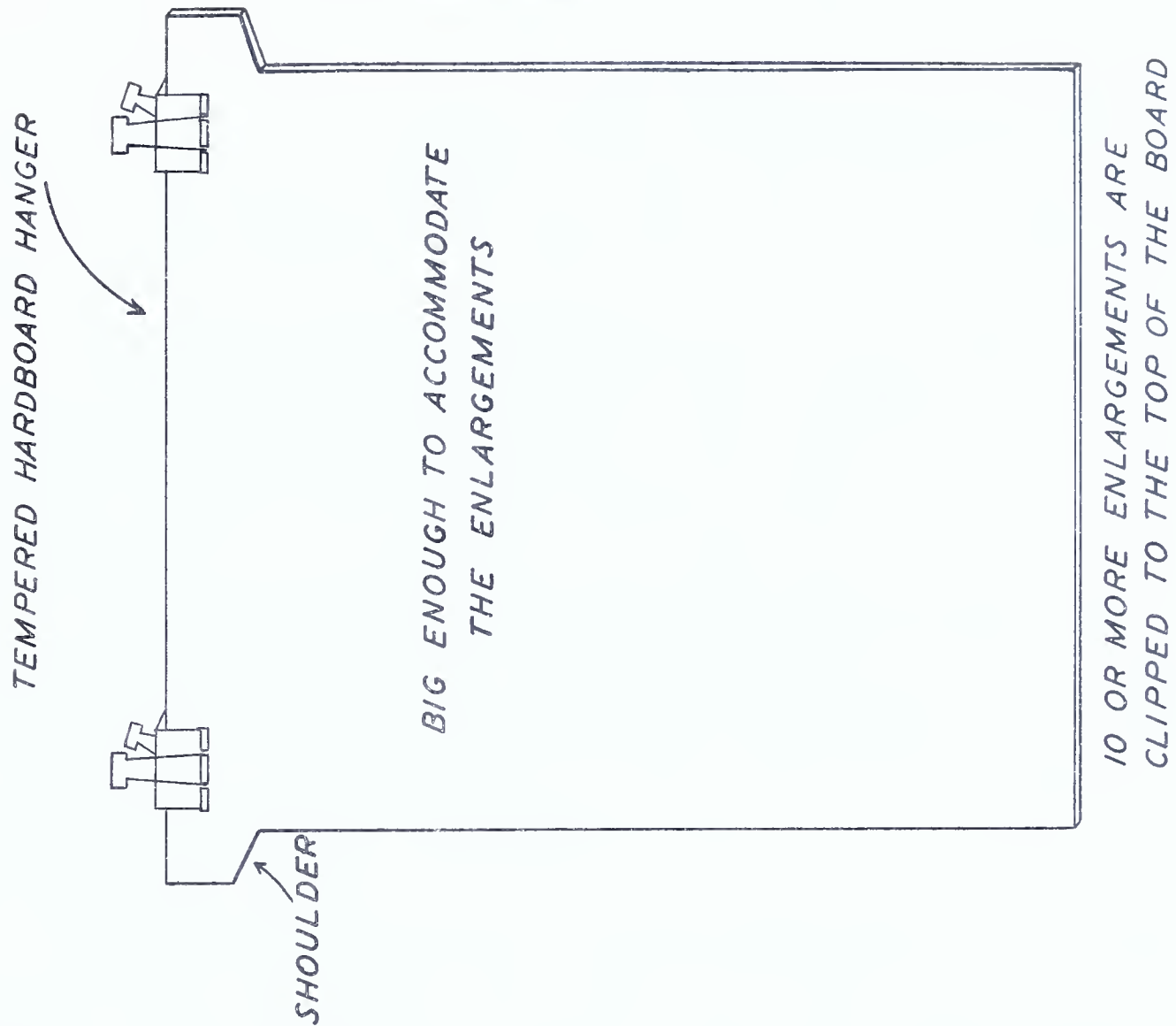


FIGURE III

sheets, the photographs, the property record cards and the ownership file so that they can be used together with the least amount of lost motion or delay.

It is required that each property be identified by a system of numbers or symbols and numbers whereby the ownership of each parcel or lot can be ascertained by reference to the property record cards or the property owners' index card.

Each map and each photograph must have a number or symbol which can be recorded on the property record card and property owners index card. Each property must likewise have a number which can be recorded on the tax map or aerial photograph and upon the property record card and property owners index card.

One system of indexing the aerial photographs would be to designate the western row with the letter A, proceeding row by row eastwardly to the eastern row in alphabetical order. Prints at the top of the row would be given the number 1, the next lower ones 2 etc, proceeding downward to the southern row in numerical order. The fourth print from the top of the third row would be designated "C 4".

Maps where used could be keyed into the system in several ways. Maps covering a portion of the same area as covered by photograph "C 4" would be designated with a symbol such as 18 - C 4 indicating that it is map number 18 as indicated on photograph C 4. These Index numbers would have to be placed upon the ratioed enlargements and other prints used and upon the photo index sheets.

However, the film roll and print numbers which are already on the aerial photographs may be used to identify them. Print AQS 3F-182 could be

identified on the property record card and the property owners index as 3F-182.

Property numbers must be assigned for each property. These numbers should follow an orderly pattern. A separate series may be used for each taxing district or for each ratioed enlargement or tax map. Probably the least complex method is to use a separate series for each tax map and photograph. Regardless of the system used, each property would have a compound number or symbol; the first portion to designate the tax map or photograph and the second part to designate the property upon that particular map or photograph. A symbol or number designating the taxing district might be prefixed to this compound number.

XV. Collection of Data

The chief assessor or persons employed by the county collect the property data. The collection of data pertaining to a farm or other property should be effected in the presence of the owner or tenant whenever possible. When this cannot be done, the information obtained should be checked by the owner or his agent.

All data placed on the field set of photographs should be entered with colored china-marking pencils, such as "Blaisdell 169-T", which is bright red. Lines drawn with this kind of pencil do not make ridges in the photographs and can be erased completely with artgum or removed with a swab of cotton dipped in carbon-tetrachloride. The china marking pencils make rather heavy lines so that if property boundaries do not follow lines visible on the photographs, notations may be necessary to locate the line in the office.

The usual procedure is to outline the property, with red pencil, write in the owner's name or number it with a temporary number and place the

same number on the form used for collecting data for the property record card. If the property contains several classes of land, these should be indicated on the photograph by subdividing the outlined property into the different classes using a green or blue china marking pencil. The class of land should be noted on each.

Other data may be placed on the photograph with pencils of other colors. These may include paved highways, springs, streams, etc., which influence the assessment. All data placed upon the photographs should be keyed into the tabulated data contained on cards, forms, or notebook pages. Notations should be made of the name of the person collecting the data, whether it was collected in the presence of the owner, tenant, or agent, or whether it was checked by the owner or his agent.

In many counties the United States Department of Agriculture has outlined boundaries of cooperating farms on similar photographs for its various farm conservation and crop control programs. Many of these photographs are at the offices of the County Agricultural Conservation Associations of the Production and Marketing Association.

The offices of the Association are usually in the County seat. The Chairman of the Production and Marketing Administration for Pennsylvania has assured the State Planning Board that these county offices will cooperate with county officials in providing information such as the farm boundaries, areas, etc.

Where difficulty is experienced in locating the boundaries of forested property upon the photographs, landmarks may often be recognized which may be used as reference points when the property boundaries are plotted and scaled upon the photograph by the county engineer or technical employees.

XVI. Verification of Data

Before property boundaries are transferred from the field set of photographs to the record set, the data should be checked against the deed description. This need not entail the plotting of the property lines from the deed description except in cases where discrepancies are obvious.

Where discrepancies are discovered, the property lines should be carefully plotted. If the deed description is faulty, the owner should be notified and the description corrected in the manner provided by law. This may require a resurvey.

After the property boundaries have been verified, a notation stating the name of the person verifying them and the date should be made and attached to the other data. All of the data should be sent to the person who is recording them on the official record photographs.

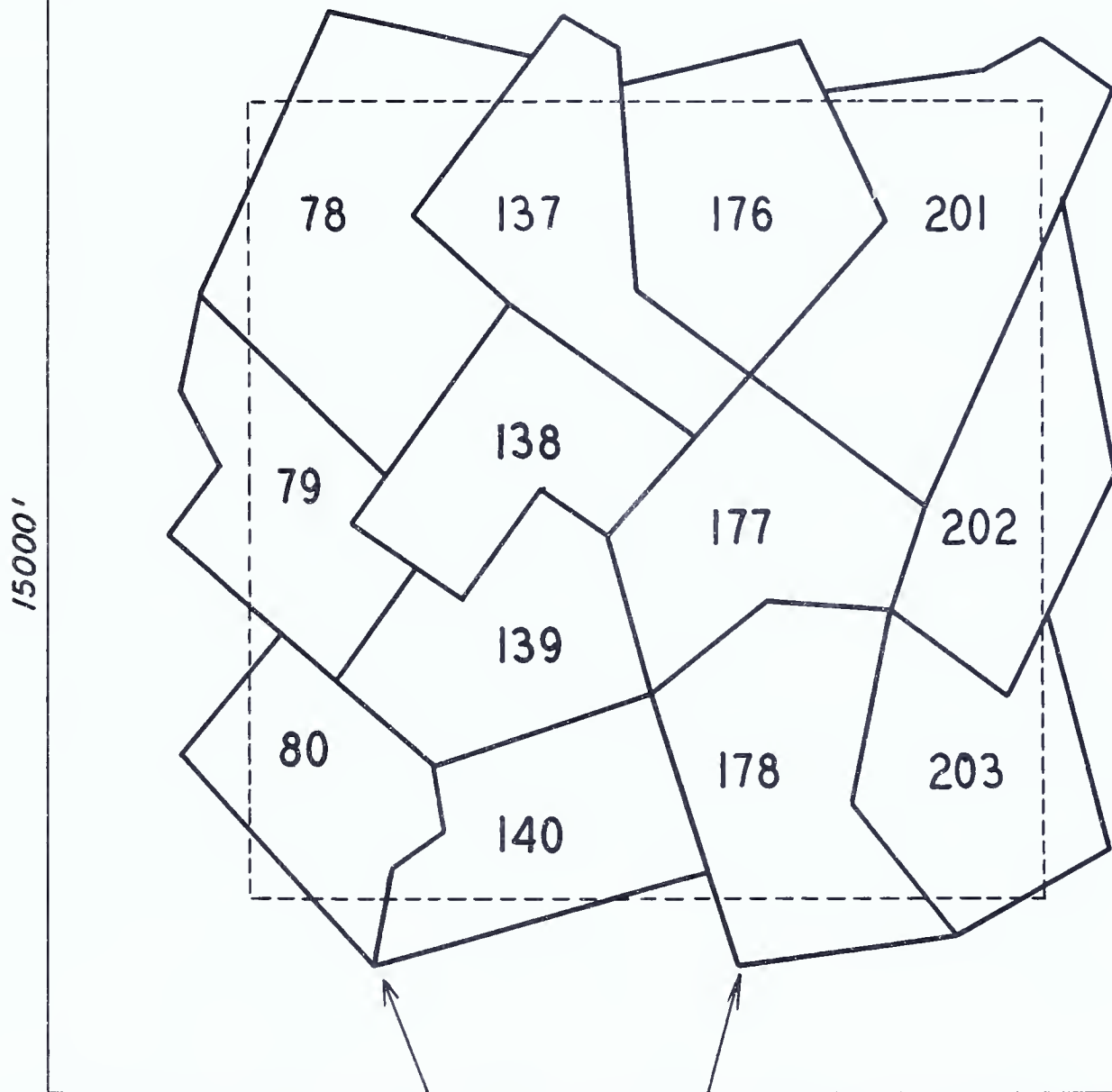
XVII. Selecting "Plotting Zones" on the photographs

Under normal procedure it is not necessary to plot properties to the very edges of each print. Although each enlargement covers an area of some 15,000 feet square, the net area covered by each print is reduced by the overlapping portions of the prints adjoining it. This net area is the central portion of each print, approximately two miles square. This central portion will be referred to as the normal "plotting zone" (see Figure IV). This zone may be outlined on the enlargements with a china-marking pencil, though some persons may prefer to use imaginary lines.

All properties which lie entirely or largely within this "plotting zone" should be recorded upon the enlargement. All properties which do not have their major portion within the plotting zone are usually plotted on the adjoining enlargement upon which most of their area will be contained in a "plotting zone".

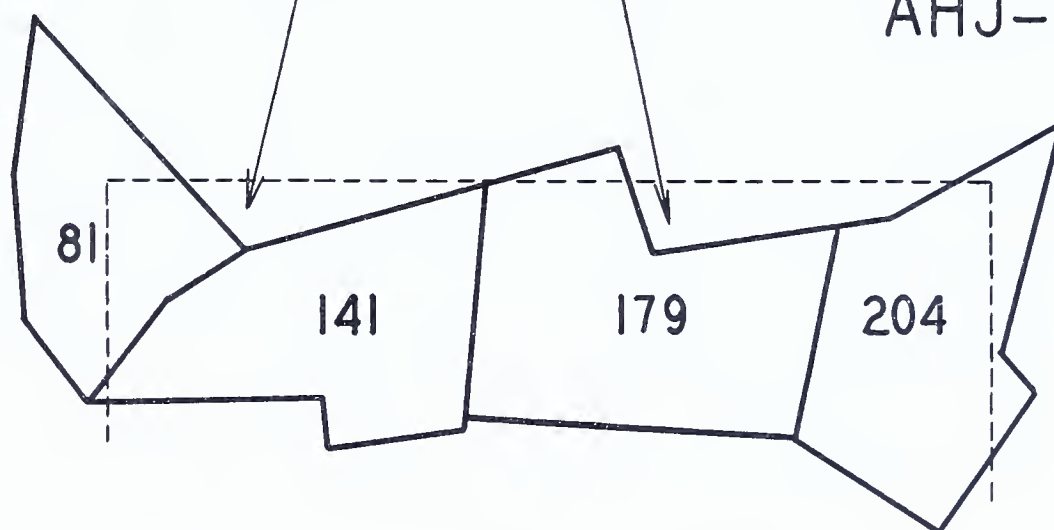
"PLOTTING ZONES"
FOR
RECORDING PROPERTIES
15000'

AHJ-1-74



NOTE: BOUNDARY LINES SHOULD BE IDENTICAL ON
ADJOINING PHOTOGRAPHS

AHJ-1-76



----- BOUNDARY OF NORMAL "PLOTTING ZONE"

FIGURE IV

In cases of extensive forest acreages and other large land-holdings it will sometimes be necessary to record the property in sections upon two or more photographs. In such a case boundary lines between sections should be natural features visible on the photographs where possible.

Figure IV shows a schematic plan of a plotting zone of an enlargement with the properties outlined and numbered. Below this diagram the top section of the next alternate print is indicated.

Referring to the illustration, Properties 78, 79, 80, 138, 139, 140, 176, 177, 178, 201, 202 and 203 are recorded on print AHJ 1-74. In each case, half or more of each of these properties falls within the normal "plotting zone".

On photograph AHJ 1-76, which is south of it, Properties 81, 141, 179 and 204 are shown. The northern boundary lines of these four properties extend to the southern boundaries of properties 80, 140, 178 and 203. For checking purposes the southern line of property boundaries on photograph AHJ 1-74 would be outlined upon tracing paper. The paper with its outline would be moved down to the top of photograph AHJ 1-76, where it should fit the northern boundaries of the properties plotted upon that photograph. Each boundary would be checked with the proper adjoining print.

XVIII. Recording Data on Photographs

After the data have been verified, they should be placed upon the photographs with colored ink or dye. Unverified data should be penciled in with colored pencil until such time as they are verified.

The record set of enlargements should have the plot boundaries, areas or dimensions, property numbers and notations as to whether or not the property is improved placed upon them in a neat and orderly manner in a way

which will not obscure the photographs. This record set is an official record and must be treated as such.

Permanent brilliant colored inks or dyes should be used. Liquid water colors such as Dunne's Lantern Slide Colors, Wold Air Brush Colors, or transparent drawing inks should be used. Air brush colors are made in two types, the water-resistant, alcohol-soluble colors being preferable.

Pens such as "Wrico" lettering pens, Number 6 or Number 5 are suitable for drawing property lines. These pens hold a drop of ink or dye and draw lines of uniform width. Regular two-blade drafting pens may be used.

Property numbers should be assigned in an orderly geographic arrangement. If a property is later subdivided, each portion may retain the original number, plus a letter, A B C etc. In assigning number each property should be included regardless of whether or not it is tax exempt.

All properties should be plotted upon their proper enlargement or tax map. If a line map has been drawn or a fire insurance map is utilized to cover an area contained on a ratioed enlargement, that area should be outlined on the photograph and properly referenced.

After all property boundaries have been placed upon the enlargement together with other data required by the Act, every property which has its major portion within the "plotting zone" should be outlined. Each outlined property should contain a property number. An unnumbered property may be one that has not been recorded.

Adjoining enlargements must be cross checked carefully, as indicated in Section XVII, after properties have been recorded to insure that no property has been overlooked.

XIX. Measuring and Scaling Upon Aerial Photographs

Although ratioed enlargements have been corrected for over-all scale discrepancy, they are not true maps, and are not entirely true to scale. Variations in scale due to the difference in elevation of various parts of the area photographed can be calculated and the photographs scaled with a high degree of accuracy.

Every effort has been made to have the ratioed enlargements accurate enough so that if corrections are made for elevations, they can be scaled to within one-half of one per cent in distance and to within one per cent in area.

The photographs have been checked in several ways for making ratioed enlargements. The most reliable way is by field checking. In field checking, measurements are made upon the ground and compared with distances scaled upon the photographs, making allowances for elevation. Usually only every third or fifth photograph is checked and ratios for the intervening photographs are computed. Most of the ratioed prints in agricultural areas are field checked.

In waste-land and in forested areas, where it was difficult to measure lines upon the ground which could be located accurately upon the photographs, other methods of checking and scale determination were used. Ratios for enlargements made of such areas are usually corrected for the average scale over a number of prints, rather than for each print. Ratioed prints of these large forested areas are not as accurate as ratioed prints of farm lands.

In plotting data upon the photographs, corrections must be made for differences in elevation, and occasionally for tilt of photographs, etc.

THE HISTORY OF THE UNITED STATES

CHAPTER I. THE DISCOVERY OF AMERICA.

IN THE YEAR 1492, CHRISTOPHER COLUMBUS, AN ITALIAN, WAS THE FIRST EUROPEAN WHO DISCOVERED AMERICA.

HE WAS SPONSORED BY THE KING AND QUEEN OF SPAIN, AND HE SET SAIL ON HIS VOYAGE ON SEPTEMBER 8, 1492.

AFTER A LONG AND DANGEROUS VOYAGE, HE REACHED THE ISLAND OF SAN SALVADOR ON OCTOBER 12, 1492.

HE WAS THE FIRST EUROPEAN TO SET FOOT ON THE CONTINENT OF NORTH AMERICA.

HE REMAINED ON THE ISLAND FOR THIRTY-THREE DAYS, AND THEN HE SET SAIL FOR SPAIN.

HE BROUGHT BACK WITH HIM SEVERAL INDIANS, WHO HE THOUGHT WOULD BE USEFUL TO THE SPANISH.

HE ALSO BROUGHT BACK WITH HIM A LITTLE GOLD, WHICH HE THOUGHT WOULD BE WORTHY OF THE KING AND QUEEN.

HE WAS RECEIVED WITH GREAT HONOR BY THE KING AND QUEEN, AND HE WAS PROMISED A LARGE REWARD.

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This is a technical procedure which can be done by a surveyor or engineer who has received some instructions in photogrammetric methods. A special bulletin on this subject will be prepared by the State Planning Board.

Acreages on the ratioed enlargements can be measured by a planimeter, an instrument costing less than one hundred dollars (See Figure V). The measurements obtained by this method must likewise be corrected for scale due to the differences in elevation, tilt of the photograph etc. However, planimetered areas on the ratioed prints in most cases will not vary more than five per cent from the correct areas, so that properties may be checked by this method for gross discrepancies. By measuring several visible field boundaries on each photograph, and comparing the measured distances with the scaled distances, planimetered areas can be adjusted to within one per cent error. The special bulletin noted above will outline this technical procedure

Areas on the ratioed enlargements at a scale of 1 inch equals 660 feet can be checked with a piece of cross-section paper having 10 divisions per inch. A piece of this semi-transparent paper can be placed over the property on the enlargement, the squares covering the property counted, and the area in acres computed by dividing by ten.

XX. Standards of Workmanship

The chief assessor and his staff are the persons designated to establish the permanent tax assessment system. Their task is a specialized one, requiring certain training and abilities. Personnel for the various positions should be selected carefully.

Recording of the data is a technical or semi-technical job. It is a task for young eyes. Good eyesight alone is however, not sufficient; a high degree of visual acuity is required. The person selected for this position should have an understanding of surveying, be a neat draftsman, and

PLANIMETER
USED FOR MEASURING AREAS



FIGURE V

be a real "plugger". His entire time should be assigned to work on the record set of photographs.

It would probably cost more to establish the system with a mediocre staff than with a competent staff. A competent staff will reduce the amount of friction between the Board of Assessment and the tax payers, produce more accurate assessments, and better quality tax maps at the lowest possible cost to the county and the tax payers.

APPENDIX A

(Cooperative Aerial Photography)

Number of Aerial Photographs Required for Physical Coverage by
Alternate Prints

(For Non-Stereo Use)

| | <u>Date</u> <u>Photographed</u> | <u>Type*</u> | <u>Number of</u> <u>Index Sheets</u> | <u>Alternate</u> <u>Prints Required</u> |
|------------|------------------------------------|--------------|---|--|
| Adams | 1949 | | 1 | 158 |
| Allegheny | 1949 | | 4 | 224 |
| Armstrong | 1949 | | 5 | 200 |
| Beaver | 1951 | | 1 | 127 |
| Bedford | 1952 | | 4 | 275 |
| Berks | 1947 | | 5 | 250 |
| Blair | 1952 | | 1 | 172 |
| Bradford | 1952 | Infra-red | 4 | 333 |
| Bucks | 1950 | | 5 | 200 |
| Butler | 1951 | | 4 | 225 |
| Cambria | 1952 | | 4 | 215 |
| Cameron | 1952 | Infra-red | 1 | 117 |
| Carbon | 1950 | | 1 | 132 |
| Centre | 1951 | Infra-red | 6 | 321 |
| Chester | 1947 | | 6 | 232 |
| Clarion | 1951 | | 4 | 170 |
| Clearfield | 1951 | Infra-red | 6 | 325 |
| Clinton | 1951 | Infra-red | 7 | 250 |
| Columbia | 1950 | | 3 | 161 |
| Crawford | 1950 | | 6 | 265 |
| Cumberland | 1947 | | 5 | 165 |
| Dauphin | 1950 | | 4 | 176 |
| Delaware | 1945 | Special | - | -- |
| Elk | 1951 | | 5 | 225 |
| Erie | 1950 | | 6 | 218 |
| Fayette | 1951 | | 4 | 233 |
| Forest | 1951 | | 3 | 125 |
| Franklin | 1949 | | 4 | 237 |
| Fulton | 1952 | | 1 | 132 |
| Greene | 1951 | | 1 | 169 |
| Huntingdon | 1952 | | 5 | 279 |
| Indiana | 1949 | | 4 | 241 |
| Jefferson | 1951 | | 4 | 170 |
| Juniata | 1949 | Infra-red | 4 | 133 |
| Lackawanna | 1950 | | 1 | 166 |

| | | | | |
|----------------|------|-----------|---|-----|
| Lancaster | 1947 | | 5 | 288 |
| Lawrence | 1950 | | 1 | 115 |
| Lebanon | 1950 | | 3 | 115 |
| Lehigh | 1947 | | 4 | 115 |
| Luzerne | 1950 | | 5 | 279 |
| Lycoming | 1951 | Infra-red | 7 | 333 |
| McKean | 1951 | | 4 | 261 |
| Mercer | 1951 | | 1 | 194 |
| Mifflin | 1950 | Infra-red | 4 | 136 |
| Monroe | 1952 | Infra-red | 4 | 187 |
| Montgomery | 1950 | | 4 | 160 |
| Montour | 1950 | | 1 | 54 |
| Northampton | 1947 | | 4 | 121 |
| Northumberland | 1950 | | 4 | 162 |
| Perry | 1949 | Infra-red | 5 | 181 |
| Philadelphia | 1945 | Special | - | --- |
| Pike | 1952 | Infra-red | 4 | 186 |
| Potter | 1952 | Infra-red | 4 | 311 |
| Schuylkill | 1947 | | 5 | 228 |
| Snyder | 1950 | Infra-red | 1 | 103 |
| Somerset | 1952 | | 5 | 323 |
| Sullivan | 1951 | Infra-red | 1 | 130 |
| Susquehanna | 1952 | Infra-red | 4 | 243 |
| Tioga | 1952 | Infra-red | 4 | 313 |
| Union | 1951 | Infra-red | 1 | 101 |
| Venango | 1950 | | 4 | 181 |
| Warren | 1950 | | 4 | 246 |
| Washington | 1951 | | 4 | 246 |
| Wayne | 1952 | Infra-red | 4 | 234 |
| Westmoreland | 1949 | | 6 | 300 |
| Wyoming | 1949 | | 1 | 127 |
| York | 1947 | | 6 | 257 |

Type* - Panchromatic unless noted

Special - Negatives owned by Aero Service Corporation, Philadelphia
(Prices quoted by them upon request)

1937-1939 Photographs are available for all counties.

PENNSYLVANIA AERIAL PHOTOGRAPHY

(Photographed in cooperation with the United States Department of Agriculture)

Vertical Aerial Photographs of every part of the State are available. Certain counties are being rephotographed. By the end of 1952 photography taken since 1945 will be available for 65 counties through the State-Federal cooperative program. Photography for the other two counties (Philadelphia and Delaware) is available from another source. Information concerning the date of the latest photography and the print numbers covering a specific area will be furnished by the Pennsylvania State Planning Board, Room 129 Capitol Building, Harrisburg, Pennsylvania.

Recent photographs are on 9 x 9 inch negatives, at an approximate scale of 1 inch = 1667 feet. Earlier photographs were on 7 x 9 inch negatives at an approximate scale of 1 inch = 1667 feet.

OVERLAP

The photographs overlap each other 65 per cent at the top and bottom (north and south) and 30 per cent at the sides (east and west). The 65 per cent overlap provides stereo pairs. Full physical coverage (non-stereo) may be obtained from alternate prints in each row.

TYPE

Most of the photography is on panchromatic film which is the type usually used for general photography. Certain counties which are predominately forested are photographed on infra-red film. Infra-red photography emphasizes differences in the green tones, and aids in identifying various species of forest cover. Prints made from the infra-red film are not as clear cut as one the usual type; shadows and wet spots appear very black.

CONTACT PRINTS are the same size as the negatives. They are usually made upon double weight semi-matte finish paper but will be furnished on single weight glossy paper if requested.

ENLARGEMENTS: Enlargements at various scales up to 1 inch equals 400 feet may be obtained. For recent panchromatic photography enlargements of one quarter of a negative to a scale of 1 inch equals 200 feet can be made.

RATIOED ENLARGEMENTS are corrected for over-all scale measurements; they should be specified for all cases where greater accuracy is required.

PHOTO INDEX SHEETS: These index sheets show the position of each individual print. They measure 20 x 24 inches. In appearance, they resemble rough mosaics. For the newer photography they are at a scale of 1:62,500 or 1 inch equals nearly 1 mile. Most of the index sheets for the older photography are at a scale of 2 inches equals one mile. The number required for each county varies.

April 1, 1952

PRICE LIST OF AERIAL PHOTOGRAPHS
Cooperative State-Federal Aerial Photography Program

CONTACT PRINTS: Price each, on double weight semi-matte paper or single weight weight glossy. Specify which. (9 x 9 inch)

| <u>QUANTITY</u> | <u>PRICE EACH</u> |
|------------------|-------------------|
| 1 to 100 | \$.65 |
| Over 100 | .50 |
| County Coverage* | .45 |

ENLARGEMENTS: These should be ordered by the scale desired. The cost of enlargements is based upon the size of sheet required to accommodate the the approximate scale requested. The size required for commonly used scales are:

| | | |
|--------------------------|---|----------------|
| 1 inch equals 1,320 feet | - | 14 x 14 inches |
| 1 inch equals 1,000 feet | - | 16 x 20 inches |
| 1 inch equals 660 feet | - | 27 x 28 inches |
| 1 inch equals 400 feet | - | 40 x 40 inches |

NOTE: - 1 square inch = 10 acres at scale of 1 inch = 660 ft.

THE PRICE OF ENLARGEMENTS

| <u>SIZE</u> | <u>1 to 5</u> | <u>6 to 100</u> | <u>Over 100</u> | <u>Quantity</u> <u>County Coverage*</u> |
|----------------|---------------|-----------------|-----------------|--|
| 14 x 14 inches | \$ 1.70 | \$ 1.10 | \$ 1.00 | \$.90 |
| 16 x 20 inches | | | | |
| 18 x 22 inches | 2.00 | 1.65 | 1.45 | 1.20 |
| 22 x 27 inches | | | | |
| 27 x 28 inches | 2.25 | 1.90 | 1.70 | 1.45 |
| 40 x 40 inches | 5.10 | 3.80 | 3.20 | 2.70 |

Enlargements at a scale of 1 inch equals 200 feet can be made from each quarter negative of the newer photography. These are made on 40 x 40 inch paper and cost \$1.00 more than the prices for regular 40 x 40 inch enlargements.

*County coverage may be either full stereoscopic coverage, or coverage by alternate prints of each row.

PHOTO INDEX SHEETS: \$1.10 per sheet.

The number required for each county varies.

ORDERING PHOTOGRAPHS: All prints and enlargements are made in Washington, D.C. They must be ordered by their identifying print numbers. Orders should be addressed to the Aerial Photographic and Engineering Service, Production and Marketing Administration, Washington, D.C. A check for the full amount payable to the Treasurer of the United States should be included. Approximately thirty days are required for filling orders.

